Machine R&D for RSVP

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Summary (the transparencies):

Experimental needs

What new is required to satisfy these needs

Three steps:

Low intensity extraction development

A return to high intensity

High intensity extraction development

Working behind RHIC

A schedule for the work

Experimental Needs:

Slow extraction with a superimposed, exquisitely clean time structure:

8 GeV microbunching (MECO)

24 GeV minibunching (KOPIO)

At very high beam intensities

20×10^{12} (Tp)/bunch
40Tp/AGS cycle (MECO)

100Tp/AGS cycle (KOPIO)

Both extraction schemes have been demonstrated at the AGS using available hardware and yielding reasonable bunch characteristics.

Neither setup was the final answer.

"Extinction" of extracted beam between the desired bunches needs work.

Paths to achieving requirements are clear.

Three other issues needing effort:

1) Achieving the desired intensities- the AGS has accelerated 70Tp/cycle with 12 Tp/bunch.

2) More conventional spill quality issues – intensity modulation on slower time scales

3) The beam loss at AGS injection for highest intensity running is about 22%. For MECO this must be reduced to about 12%.

Plan Step 1:

Understand the desired Slow Extraction setups
at very low intensity.

simpler, cleaner situation than at high intensity and relevant

a) **MECO**: the basic bunching hardware is ready– (slow extraction below transition); vertical extraction aperture question. A preliminary version of the gap cleaning hardware exists for study.

b) **KOPIO**: the bunching setup will lack the final hardware for several years. The intent of the R&D is to obtain very good agreement between simulations and the results measured with beam using available hardware (i.e. RF cavities). The extracted beam parameters to understand are bunch width, “extinction”, and beam not extracted.

c) **the basic MECO slow extraction** would be the way we cope with high intensity beam dumping in the near future.

Plan step 2:

Intensity:

Understand the high intensity situation in the Booster

Optimize (Booster to AGS) transfer under “MECO” constraints.

Can we achieve > 20Tp/cycle with h=1 acceleration?

If not, revert to the h=2 strategy.

a) Commission the RF hardware/controls - new since the last high intensity run (E949, spring of ’02).

b) Develop external dump capability early on. This is necessary once we exceed the capabilities of the rings internal dumps, but we want to develop this capability in step with the intensity increases. (“MECO” extraction).

c) Minimize losses during the Booster to AGS transfer with MECO's relaxed longitudinal constraints.

Plan step 3:

Understand the desired Slow Extraction setups at high beam intensity.

a) conventional slow extraction quality degrades as intensity increases (spill structure). Understand the magnitude of the effects– at least enough to cope. The problems may be quite different for the two extraction energies.

b) the amount of beam in the gaps will probably increase with intensity – for both setups. Measure and figure out how to fix. (machine impedance, allowed dp/p).

Understand any constraints associated with achieving highest intensity acceleration while working behind RHIC.

R&D / Commissioning Schedule

(this planning assumed "base" funding starting in 2005)

year 1 (’04)	very low intensity	
		bunched extraction
		8 GeV extraction
year 2 (’05)	high intensity Booster, moderate intensity AGS	
		8 GeV extraction
		bunched extraction
		Coexist with RHIC
year 3 (’06)	high intensity	
		intensity effects
year 4 (’07)	high intensity	
	new equipment:	AGS injection kicker
		KOPIO 25 MHz cavity
year 5 (’08)	commissioning run	

The final table from AGS commissioning plan (the plan is listed on the web at the site for this review) giving the yearly bottom line time requirements from this planning:

Fiscal Year	'04	'05	'06	'07
	sessions	sessions	sessions	sessions
basic setup		9	10	10
intensity		12	10	10
MECO, low intensity work	17	3	0	0
MECO, high intensity work	0	0	3	5
KOPIO, low intensity work	13	3	0	7
KOPIO, high intensity work	0	0	3	5
total sessions	30	27	26	37
	days	days	days	days
required calendar days	30	54	52	74
with high intensity penalty	30	54	60	84
	days	days	days	days
potential unused (between sessions) time	0	27	26	37

Roughly two months of work each year.

This can fit behind RHIC running.